

Research Project 1- Solar Sail Dynamics at the Vicinity of L_1

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I. Abstract

This study explores the dynamics of a solar sail spacecraft around the Sun-Earth first Lagrange point (L_1), based on the work by Bookless and McInnes [1]. The reproduction of their work is done as a groundwork for future research. First, Hill's equations of motion are developed, resulting in two libration points symmetric around Earth- L_1 and L_2 . While the gravitational potential is identical due to Hill's approximation, the solar sail acceleration in these areas distinguishes them. Jacobi's Integral is derived from the equations of motion and equal energy surfaces are shown for L_2 . Due to Hill's approximation, L_1 and L_2 are symmetric. The linearized equations of motion are utilized to generate the Lissajous trajectory. Initial conditions for inserting the satellite into this trajectory are developed. In future work, we will use the models derived in this project to control a single spacecraft and a formation of multiple spacecraft at L_1 to act as a space sunshade for Earth.

References

- [1] Bookless J. ,McInnes C. , "Control of Lagrange Point Orbits Using Solar Sail Propulsion," *Acta Astronautica*, Vol. 62, 2008.

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